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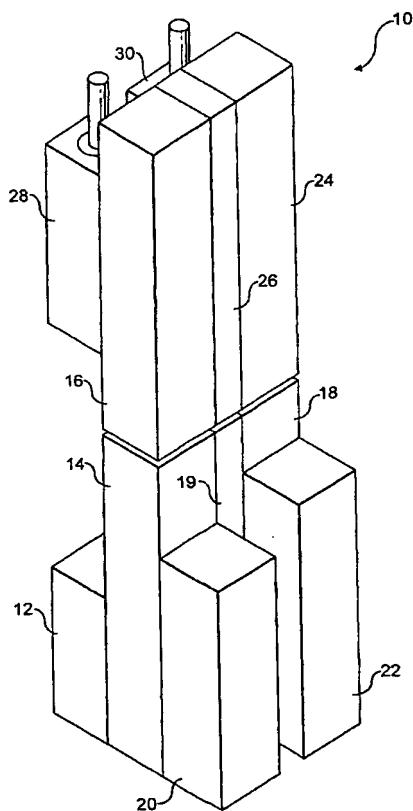
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[Continued on next page]

(54) Title: APPARATUS FOR CRYOGENIC AIR DISTILLATION



(57) Abstract: Apparatus for the cryogenic distillation of air (10), said apparatus comprising an assembled unit that comprises a first distillation column module (14) within which is provided at least one cryogenic distillation column; a heat exchange module (12) within which is provided heat exchange means for cooling column feed air to a cryogenic distillation temperature; and at least one further processing unit (16, 18, 20, 22, 28, 30). The or each distillation column, said heat exchange means and the or each further processing unit are operationally interconnected and the assembled unit is suitable for transportation to and erection at the site for a cryogenic air separation plant. One advantage of the apparatus is that construction of a cryogenic air distillation plant is simplified resulting in a reduction in construction cost and time of construction. In addition, as components of the apparatus are self-contained within modules, the risk of contamination of the internal components is reduced thus improving control of the quality of the construction.

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ML, MR, NE, SN, TD, TG).

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INTERNATIONAL SEARCH REPORT

International Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F25J3/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F25J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category ^a	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No -
X	FR 2 780 147 A (AIR LIQUIDE) 24 December 1999 (1999-12-24) page 1, line 25 - line 28 page 5, line 8 - line 21 page 9, line 21 - line 24 page 10, line 24 - page 11, line 6 page 12, line 7 - line 28 page 14, line 28 - line 31; claims 25,26; figures 3,5A-5C,8,9 -----	1-10,13, 15-26, 30,31
X	EP 1 182 412 A (LINDE AG) 27 February 2002 (2002-02-27) paragraphs [0007], [0010], [0020], [0023], [0025]; claim 2 ----- -/-/	1,6-13, 16,17, 19-26, 30,31

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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- "P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 103 772 A (LINDE AG) 30 May 2001 (2001-05-30) paragraphs [0008], [0010], [0012], [0023], [0026]; figures -----	1,6-10, 13, 16-26,30
A	DE 100 51 141 A (AIR LIQUIDE) 19 April 2001 (2001-04-19) page 1, line 29 - line 32 page 6, line 19 - line 27; claims 1,12; figures -----	1,6,7,9, 10,16, 17, 19-26,30
A	EP 1 041 353 A (BOC GROUP INC) 4 October 2000 (2000-10-04) figure 2 -----	2,3
A	US 5 349 827 A (GRELAUD ALAIN ET AL) 27 September 1994 (1994-09-27) column 1, line 8 - line 37 column 2, line 13 - line 22 -----	4,5
A	US 6 128 921 A (GUILLARD ALAIN ET AL) 10 October 2000 (2000-10-10) column 3, line 27 - line 57 -----	4,5
A	US 5 461 871 A (GRELAUD ALAIN ET AL) 31 October 1995 (1995-10-31) cited in the application column 3, line 45 - line 57 column 4, line 11 - line 14; figures -----	10-18
A	DE 28 22 774 A (LINDE AG) 29 November 1979 (1979-11-29) page 3, paragraph 4 -----	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2004/001343

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple Inventions in this International application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the Invention first mentioned in the claims; it is covered by claims Nos.:

1-26, 30, 31

Remark on Protest

The additional search fees were accompanied by the applicant's protest.
 No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-26,30,31

Apparatus, method respectively use of an apparatus for the cryogenic distillation of air comprising an assembled unit. The assembled unit comprises a first distillation column module, a heat exchange module and at least one fluid processing unit being operationally interconnected, and is transported to and erected at a site for a cryogenic air separation plant.

2. claims: 27,28,29

Use of processing means selected from a first distillation column module, a heat exchange module and at least one fluid processing unit in the construction of an assembled unit the latter being incorporated into apparatus for the cryogenic distillation of air and being suitable for transportation to and erection at the site for a cryogenic air separation plant.

INTERNATIONAL SEARCH REPORT

Information on patent family members

Interr.....	Application No
PCT/GB2004/001343	

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
FR 2780147	A	24-12-1999	FR US	2780147 A1 6360815 B1	24-12-1999 26-03-2002
EP 1182412	A	27-02-2002	DE AU CN WO EP EP TW US	10040396 A1 9546001 A 1447894 T 0216846 A1 1182412 A1 1311790 A1 500907 B 2004035149 A1	28-02-2002 04-03-2002 08-10-2003 28-02-2002 27-02-2002 21-05-2003 01-09-2002 26-02-2004
EP 1103772	A	30-05-2001	DE EP	19957017 A1 1103772 A1	31-05-2001 30-05-2001
DE 10051141	A	19-04-2001	FR DE GB JP	2799822 A1 10051141 A1 2358909 A 2001165565 A	20-04-2001 19-04-2001 08-08-2001 22-06-2001
EP 1041353	A	04-10-2000	US EP	6134915 A 1041353 A2	24-10-2000 04-10-2000
US 5349827	A	27-09-1994	FR CA DE GB JP	2692663 A1 2098437 A1 4320027 A1 2267958 A ,B 6066042 A	24-12-1993 18-12-1993 23-12-1993 22-12-1993 08-03-1994
US 6128921	A	10-10-2000	FR AU AU BR CZ DE GB JP	2774753 A1 738523 B2 1472499 A 9904194 A 9900409 A3 19904527 A1 2334084 A ,B 11264658 A	13-08-1999 20-09-2001 26-08-1999 01-08-2000 17-11-1999 12-08-1999 11-08-1999 28-09-1999
US 5461871	A	31-10-1995	FR CA CN CN DE DE EP ES JP	2706025 A1 2124898 A1 1118277 A ,B 1261653 A 69402914 D1 69402914 T2 0629829 A1 2104301 T3 6347164 A	09-12-1994 04-12-1994 13-03-1996 02-08-2000 05-06-1997 18-12-1997 21-12-1994 01-10-1997 20-12-1994
DE 2822774	A	29-11-1979	DE	2822774 A1	29-11-1979